

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**



(58) Field of Search  
UK CL (Edition N ) G4A ADT AKS  
INT CL<sup>6</sup> G06F 1/16 1/18  
ONLINE : WPI

GB 2287 556 A

BNSDOCID: &lt;GB 2287556A &gt;



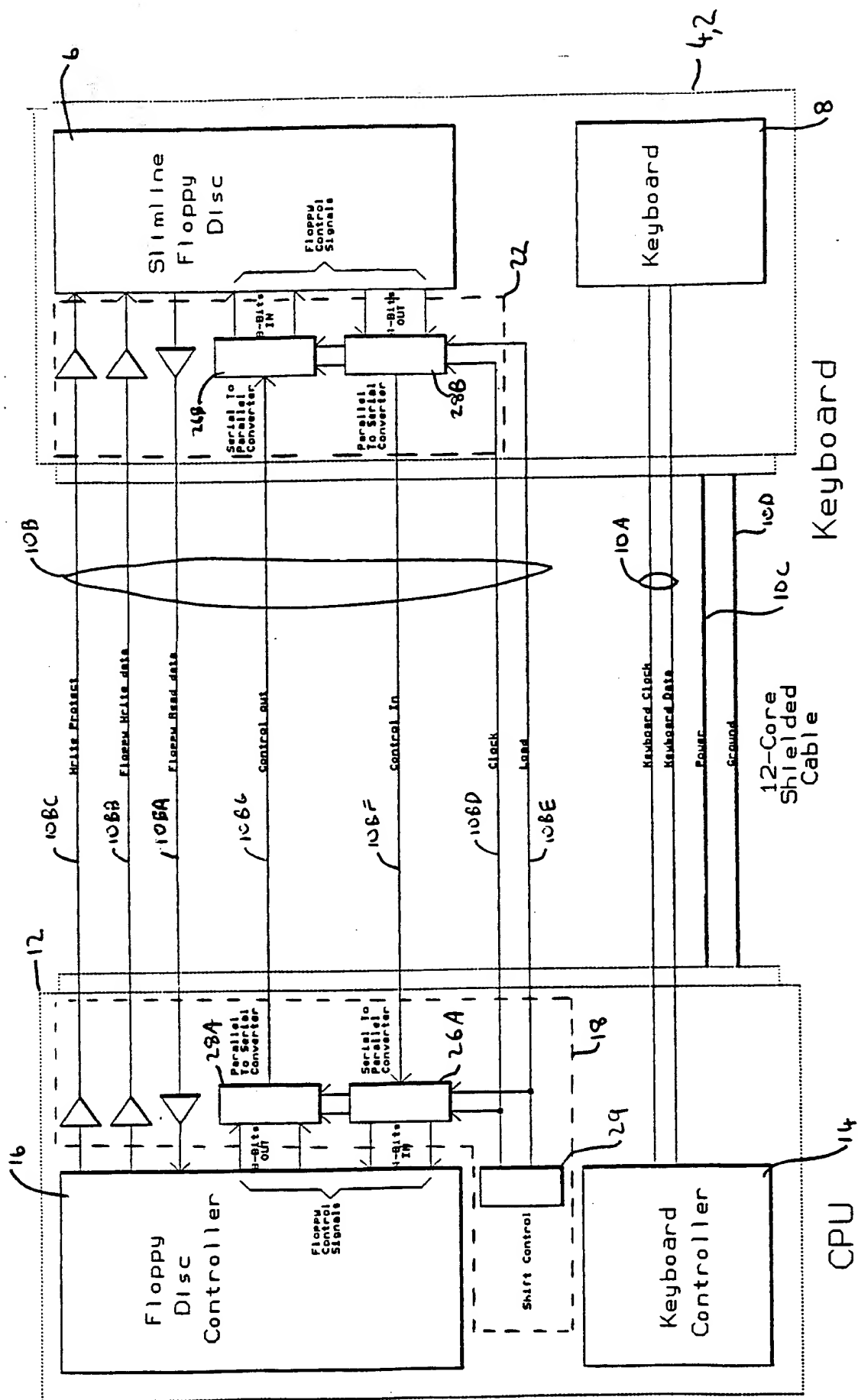


Fig. 2

COMPUTER INPUT APPARATUS

This invention relates to computer input apparatus.

5 Presently, a typical personal computer for use in an office  
or home environment comprises three separate units, namely  
a systems unit which houses a CPU and associated support  
circuitry, interface boards, memory and one or more disk  
drives, a keyboard and a display device such as a CRT  
10 monitor.

Often desk-space is at a premium and it is therefore  
desirable to avoid having all three units positioned on the  
desk. A common solution is to position the systems unit on  
15 its side so that it uses vertical rather than horizontal  
space on the desk, or to remove the systems unit from the  
desk altogether and to position it on the floor beside the  
desk. However it is not always possible to conveniently  
re-arrange the systems unit in this way since it may reduce  
20 legroom and since it is usually necessary to gain access to  
the systems unit to insert and remove removable storage  
media such a floppy disk, a CD-ROM or a tape cartridge.

Recently, it has become possible to connect external disk,  
25 tape and CD-ROM drives to a computer via a parallel printer  
port. These devices permit better use of desk space since  
the systems unit may not need to be accessible if all such  
accesses may be made via the external drive instead.  
However these devices themselves are relatively bulky since  
30 they usually incorporate a power supply unit. Furthermore,  
software must be loaded into the computer to adapt the  
operation of the computer's parallel port before the device  
can be used. This means that the device cannot be used as  
a boot device and under certain circumstances, that it is  
35 incompatible with other software or hardware.

According to this invention, computer input apparatus comprises the combination of a first interface circuit for coupling to the disk drive controller of a computer and a remote keyboard unit for remote coupling to the first  
5 interface circuit, the keyboard unit having a keyboard, an integral disk drive, a second interface circuit coupled to the drive and arranged to be remotely coupled to the first interface circuit, whereby in use, a remote connection is established via the first and second interface circuits  
10 between the disk drive and the disk drive controller.

The apparatus may also include a serial data link having serial connections respectively for control signals in at least one direction between the two interface circuits and  
15 having shift control connections for shift control signals which control the conversion of the serial data from a parallel format to a serial format and vice versa. The data link may further comprise connections respectively for a floppy write protect, a floppy read data and/or a floppy  
20 write data signal.

The interface circuits serve to convert signals for transmission between the disk drive and the disk controller into a format suitable for remote connection. In this way,  
25 a standard disk controller is retained which reduces costs and improves compatibility. Preferably the interface circuits operate such that the remote connection between the disk drive and disk controller is transparent in the sense that the disk drive and disk controller operate as if they  
30 were connected directly together. In particular, the disk drive is preferably a bootable drive.

Generally, a disk drive is connected to its controller via a parallel connection which for a floppy disk drive may  
35 comprise 20 connections. Preferably, this number of connections is reduced by transmitting at least some of the signals in a serial format thereby reducing the number of

conductors required in a cable connecting the two interface circuits. In a preferred embodiment, all signals other than a write protect signal, a floppy read data signal and a floppy write data signal are transmitted in a serial format.

5 In this way, the number of conductors required is reduced from 20 to 12. Preferably the reduction is sufficient to permit the remote connection to be established via a cable of similar thickness to that of a standard computer keyboard cable. Preferably this cable also contains the standard  
10 interconnections required for the computer keyboard.

Preferably, the disk drive is a 3.5 inch floppy or floptical drive of a suitable height for mounting in the keyboard housing without unduly compromising the operating height of  
15 the keyboard. Preferably the disk drive is a very low profile disk drive of about 0.5 inch height.

In the context of this application, disk drive and disk drive controller are taken to include devices such as a  
20 CD-ROM and a tape drive and controller respectively.

The invention will now be described by way of example with reference to the drawings in which:-

25 Figure 1 is a schematic block diagram of a keyboard unit connected to a systems unit in accordance with the invention; and

Figure 2 shows the first and second interface units of  
30 Figure 1 in greater detail.

With reference to Figure 1, a remote computer keyboard comprises a keyboard unit 2 having a housing 4 within which a slimline disk drive 6 and a computer keyboard 8 are  
35 housed. The keyboard unit 2 is connected via a cable 10 to a systems unit 12 of a personal computer. The systems unit 12 houses a standard keyboard controller 14 connected to the



keyboard 8 via conductors 10A of the cable 10, and a standard disk controller 16.

One of the connections for a disk drive provided by the  
5 controller 16 is connected to a first interface circuit 18  
also housed in the systems unit 12, via a standard ribbon  
cable 20. This first interface circuit 18 is connected via  
a second set of conductors 10B of the cable 10 to a second  
interface circuit 22 housed in the keyboard unit 2. The  
10 second interface circuit is connected to the disk drive 6  
via a second standard ribbon cable 24.

Figure 2 shows the interface circuits 18, 22 and the cable  
10 in greater detail. To connect all the control signals to  
15 the floppy disk drive 6 and the keyboard 8 in a parallel  
format would require 20 conductors. Each of these signals  
would require connection, buffering and termination.  
However, by reducing twelve of these signals to four serial  
data streams using serial-to-parallel conversion shift  
20 registers 26A, 26B and parallel-to-serial conversion shift  
registers 28B, 28A, the cable size is reduced to a  
manageable twelve cores which can be fitted into a flexible  
telephone-type helical cable. These registers are connected  
respectively together via two serial control lines 10BF,  
25 10BG. The registers 26, 28 are controlled by a shift  
controller 29 which provides a clock and a load signal for  
all the registers 26, 28 to synchronise the shifting of data  
within the registers and the loading/unloading of complete  
data words once conversion is finished for a respective data  
30 word. The shift control signals i.e. the clock and load  
signals, are connected via lines 10BD and 10BE of cable 10.

However, in the preferred embodiment, not all the signals  
undergo this serial conversion process. The two keyboard  
35 signals 10A already form a serial data stream, these are  
connected directly from the keyboard 8 to the keyboard  
controller 14 in a conventional way. The read-data 10BA and

write-data 10BB signals are very sensitive to timing variations and to avoid introducing timing errors during the serial conversion process, in a preferred embodiment these signals are also connected directly without conversion. In addition, the write-protect line 10BC which prevents inadvertent writes to a floppy disk, is a critical signal which has the potential of permitting data corruption on the disk and is, in the preferred embodiment, not subjected to the serial conversion process. These three disk control lines 10BA, 10BB, 10BC, the two shift control signals 10BD, 10BE in addition to the two keyboard lines 10A and a power 10C and ground 10D conductor are connected individually.

Thus, the data link formed by the cable 10 comprises two serial control lines 10BF, 10BG for transmitting data respectively to and from the first interface circuit to the second interface circuit and also a pair of shift control signals 10BD, 10BE. In addition, the data link may also comprise separate lines 10BA, 10BB, 10BC for write protect, floppy read data and/or floppy write data signals. Alternatively, the serial line 10BF, 10BG may carry the read data, the write data and/or the write protect signals.

At least some of the lines are provided with error detection which in the preferred embodiment, operates by transmitting the same data at least twice and double-buffering the data at the receiver i.e. by storing the previous data at the receiver end. The previous data is then compared with the newly transmitted data to ensure that they match. If a match is not found then one of the previous or new data are corrupt and retransmission occurs.

Typically the cable 10 is about three metres long and since the frequency of the signals being transmitted along it may approach 10MHz, consideration must be given to noise and transmission line effects which could lead to data corruption. The cable 10 is a 12-core shielded cable. Each

core is terminated at each respective receiving end with a 47 $\Omega$  resistance connected to ground. It has not been found necessary to resort to balanced twisted pair techniques although in electrically noisy environments this and other  
5 noise reducing techniques known to the skilled man may be used.

Further reductions in cable size may be possible using more sophisticated coding schemes and error correction however  
10 such approaches are generally more expensive.

CLAIMS

1. Computer input apparatus comprising the combination of  
5 a first interface circuit for coupling to the disk  
drive controller of a computer and a remote keyboard  
unit for remote coupling to the first interface  
circuit, the keyboard unit having a keyboard, an  
10 integral disk drive, a second interface circuit coupled  
to the drive and arranged to be remotely coupled to the  
first interface circuit for providing a remote  
connection between the disk drive and the disk drive  
controller via the first and second interface circuits.
- 15 2. Apparatus according to claim 1, wherein the first and  
second interface circuits include serial-to-parallel  
and parallel-to-serial conversion means respectively  
and/or vice versa, and are arranged to permit at least  
some signals transmitted between the circuits to be  
20 transmitted in a serial format.
3. Apparatus according to claim 2, wherein the interface  
circuits are arranged for the serial transmission of  
control signals in at least one direction between the  
25 circuits, and for the transmission of shift control  
signals for controlling the conversion means.
4. Apparatus according to claim 3, wherein the interface  
circuits are further arranged for the transmission of  
30 a disk write-protect signal, a disk read-data signal  
and/or a disk write-data signal between the circuits.
5. Apparatus according to any preceding claim, wherein the  
first and/or second interface circuit includes error  
35 detection means for detecting errors in at least some  
of the signals transmitted between the circuits.

6. Apparatus according to any preceding claim, wherein the total number of electrical conductors forming the remote coupling between the remote keyboard unit and a computer is not greater than twelve.
- 5 7. Apparatus according to any preceding claim, arranged to permit boot operation of the integral disk drive.
- 10 8. A computer including input apparatus comprising the combination of a first interface circuit coupled to the disk drive controller of the computer and a remote keyboard unit for remote coupling to the first interface circuit, the keyboard unit having a keyboard, an integral disk drive, a second interface circuit  
15 coupled to the drive and for remote coupling to the first interface circuit for providing a remote connection between the disk drive and the disk drive controller via the first and second interface circuits.
- 20 9. Computer input apparatus constructed and arranged substantially as herein described with reference to the drawings.



Application No: GB 9405220.6  
Claims searched: 1-9

Examiner: Mr S J Probert  
Date of search: 7 June 1995

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.N): G4A ADT, AKS  
Int CI (Ed.6): G06F 1/16, 1/18  
Other: Online : WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB2258325A (Ying Kuang Shih & Hsi Kuang Ma)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.